

LESSON PLAN

PART I
COVER SHEET

LESSON TITLE: Operation of the A/E32U-13 Smoke Generator

TRAINING METHOD: Demonstration Performance

ORGANIZATIONAL PATTERN: Sequential

REFERENCES: T.O. 11C12-2-7-1, Generator, Smoke, Mechanical, A/E32U-13 and Control, Remote, Smoke Generator, MXK-856/E32U-13
Technical Report JCCD-94-1, Air Base Camouflage, Concealment, and Deception Guide

AIDS AND HANDOUTS: A/E32U-13 Smoke Generator with Remote Control (if available).
The following aids are found in T.O. 11C12-2-7-1:
Generator, Smoke, Mechanical, A/E32U-13
Control, Remote, Smoke Generator, MXK-856/E32U-13:
Figure 3-5 (sheet 1 of 4). Engine Exhaust Danger Area.
Figure 3-5 (sheet 2). Major Components of Smoke Generator.
Figure 4-3. Engine Fuel System.
Table 1-2. Engine Fuel Types and Temperature Ranges.
Figure 1-3. Fuel and Smoke Material Temperature Ranges.
Table 4-2. Smoke Generator Cabinet Controls and Indicators
Figure 4-10. Smoke Generator Cabinet Controls and Indicators.
Table 4-3. Receiver Controls and Indicators.
Figure 4-11. Receiver Assembly Controls.
Table 4-4. Transmitter Assembly Controls and Indicators.
Figure 4-12. Transmitter Assembly Controls and Indicators.

LESSON OBJECTIVE: Given an explanation and demonstration of the A/E32U-13 Smoke Generator, the student must successfully complete the task steps and the samples of behavior below.

SAMPLES OF BEHAVIOR:

1. Identify the main purpose of the smoke generator system.
2. Identify safety requirements of the smoke generator.

STRATEGY: This lesson plan teaches the basic smoke generator system operational procedures. Procedures for employing smoke and obscurants are taught in DPTP K6, Large Area Smoke Screens. This lesson also does not include lessons on the Trailerized Smoke Generator System, consisting of the rack system with fuel barrels and the MHU-141/M Munitions Handling Trailer. Additionally, this lesson does not include training on the Multi-Spectral Smoke Generator Infrared (MSSG IR) Module Package for the A/E32U-13 Smoke Generator. When available, actual equipment should be used. If unavailable, this lesson can only be taught to the knowledge level. Teamwork and safety procedures must be stressed throughout the lesson. If actual equipment is used, task demonstrations should first be conducted by the instructor, followed by maximum hands-on performance by each student. Each student should be rotated through the different tasks as outlined in the technical order.

LESSON OUTLINE:

MAIN POINT 1. PURPOSE AND SCOPE

MAIN POINT 2. SAFETY PRECAUTIONS

MAIN POINT 3. THEORY OF OPERATION

- a. Smoke Generator
- b. Remote Control System
- c. Fuel Supply
- d. Smoke Material Supply

PART II TEACHING PLAN INTRODUCTION

ATTENTION:

Imagine deploying to a bare base somewhere in the world. There are very few assets in place to protect you from an attack that could come at any time.

MOTIVATION:

Early entry survivability may be the key to waging a successful war, and the A/E32U-13 Smoke Generator is a fast, effective way to protect your assets from either an aerial or ground attack.

OVERVIEW:

This lesson will cover the purpose and scope of the smoke generator, safety precautions to take before, during, and after operation, and the components of the A/E32U-13.

Additionally, you will be taught operating procedures under different conditions and proper shut down procedures.

TRANSITION:

Let's begin by discussing the purpose and scope of the smoke generator, A/E32U-13. We'll use the simpler term "smoke generator" throughout this lesson.

BODY

MAIN POINT 1. PURPOSE AND SCOPE

The smoke generator system can provide a short duration curtain of smoke which drifts vertically, or a blanket to horizontally cover the base. In either use, the main purpose is to cover operations from enemy view. This falls under the CCD principle of hiding.

a. MULTI-FUEL TURBINE

The smoke generator system is a multi-fuel turbine powered system.

b. MANUAL OR REMOTE CONTROL

The smoke generator can be started, produce smoke, and stopped by two methods. To operate the smoke generator manually, use a switch mounted to the side of the system. For remote operation, commands are transmitted to the receiver from a distance of up to 5 kilometers. To use the remote transmitter, you must be in a straight line-of-sight position.

c. CABINET

The system consists of a cabinet containing a turbojet engine and accessories for system starting, operation, and control.

d. ENGINE FUEL CONSUMPTION

The engine itself consumes about 25 gallons of JP4, JP8, or diesel fuel per hour.

e. SMOKE MATERIAL CONSUMPTION

When producing screening smoke, the system consumes about 140 gallons of smoke material per hour.

TRANSITION:

Before we go further, let's cover some general safety guidelines to observe when working with the smoke generator.

MAIN POINT 2. SAFETY PRECAUTIONS

a. WEAR PERSONAL PROTECTIVE EQUIPMENT

The following general precautions apply anytime you are operating this equipment. Specific safety procedures are covered in the technical order when going through inspection and operation instructions. Everyone working with and around the smoke generator must understand and apply these precautions to ensure personal safety and health, and to protect Air Force property.

Wear personal protective equipment such as gloves, apron, and eye protection that is approved for the materials, procedures, and tools being used. If necessary, contact the Bioenvironmental Engineer or Wing Safety Office for guidance.

Many components or tools have sharp edges. Exercise care to prevent injuries from occurring.

Remove rings, watches, necklaces, or other metallic objects that may cause shock or burn injuries.

Anyone operating the smoke generator must think safety at all times. Do not replace components or make adjustments inside the equipment with the electrical supply turned on. Danger may exist when the power is off because capacitors hold an electrical charge.

To avoid electrical shock, always disconnect the power. Additionally, discharge and ground a circuit before touching it.

Anyone working with or near dangerous voltage must be trained in modern methods of resuscitation. Information and training sources may be obtained from the Director of Base Medical Services.

Compressed air can cause serious damage or injury by blowing foreign particles at high speeds. Reduce all air pressure to less than 30 psi and use personal protective equipment as necessary.

If an item cannot be lifted with ease, use two or more personnel for the task. When you have the proper number of lifters, be sure to use proper lifting techniques or injury to personnel or damage to equipment will result.

Carbon monoxide gas is present in the exhaust gases of this equipment. Carbon monoxide is a colorless, odorless, deadly poisonous gas, which when breathed, deprives the body of oxygen and causes suffocation.

Do not confuse carbon monoxide poisoning with chemical warfare agent poisoning. Your mask will not protect you from carbon monoxide fumes.

Some symptoms of carbon monoxide poisoning include headaches, dizziness, loss of muscular control, apparent drowsiness, and even coma. Permanent brain damage or death can result from severe exposure.

Do not operate this equipment in an enclosed area. Adequate ventilation is a must. Be alert at all times during smoke generator operation for exhaust odors and exposure symptoms. Stand upwind during engine and smoke operations.

Hearing protection is required when working within 70 feet of an operating smoke generator. Do not start the smoke generator without wearing hearing protection.

INSTRUCTORS NOTE: Use Figure 3-5, sheet 1 of 4 of to 11c12-2-7-1 to show distances around the smoke generator for the following safety precaution

Do not stand or walk within 50 feet of the exhaust area during start-up or the running of the smoke generator due to hot exhaust and exhaust blast.

On attempting a second start, a hot start may result with a large flame initially exiting the exhaust area. If a hot start occurs, do not shut down the smoke generator. If you do shut it down, the residual fuel could cause a fire.

Minor eye and respiratory irritation may occur to personnel exposed for long periods of time to the smoke. Minor skin irritation may occur to personnel with sensitive skin.

For maintenance safety: when maintenance is to be performed immediately after shutdown of the smoke generator, wait for the engine to cool or maintenance personnel may be burned by hot components.

TRANSITION:

With these safety precautions set firmly in your mind, let's discuss the theory of operation of the smoke generator.

MAIN POINT 3.
THEORY OF
OPERATION

By understanding the components of the smoke generator system, you will have a better insight into it's theory of operation. The following components make up the smoke generator system:

a. SMOKE
GENERATOR

The smoke generator is the primary component and consists of a turbojet engine and a remote control assembly mounted in a cabinet. A fuel supply hose assembly, fuel pressure hose assembly, and a smoke material supply hose assembly complete the components.

INSTRUCTORS NOTE: USE FIGURE 3-5, SHEET 2 OF T.O. 11C12-2-7-1 TO SHOW THE MAJOR COMPONENTS OF THE SMOKE GENERATOR.

1) TURBOJET ENGINE

The turbojet engine has been adapted from its original aircraft application to a smoke generator application. This was done by adding a straight exhaust duct to the exhaust manifold.

2) ENGINE FUEL
SYSTEM

The engine fuel system is capable of using various fuels ranging from JP4 to diesel. A fuel metering valve is a two-position valve that allows the engine to run on JP4 when turned clockwise. All other fuels may be used when the valve is turned counterclockwise.

INSTRUCTORS NOTE: USE FIGURE 4-3 OF TO 11C12-2-7-1 TO EXPLAIN THE ENGINE FUEL SYSTEM COMPONENTS.
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3) ENGINE IGNITION
SYSTEM

The ignition system consists of a high-energy exciter that powers a spark igniter plug.

4) ENGINE OIL
SYSTEM

The oil system is completely self-contained within the engine. The oil pump supplies oil to the drive gears and main engine bearings. A machine fitting located on the upper part of the intake casing contains an oil filter.

5) SMOKE OIL
SYSTEM

The smoke oil system consists of a quick-disconnect coupling, a smoke material pump, a check valve in the pump delivery line, and the engine exhaust duct/smoke manifold assembly containing 10 spray nozzles. These nozzles inject the fog oil directly into the exhaust of the engine gases.

6) ELECTRICAL
SYSTEM

The electrical system consists of three major subsystems: the battery pack, the starter-generator, and the electrical control unit.

a) TWO 24 VDC
BATTERIES

The battery pack contains two 24 volts DC lead-acid batteries that supply power to the engine accessories and the remote control assembly during engine starts. After the engine has started, the batteries are charged by the starter-generator through a voltage regulator in the electrical control unit. Operating hours are recorded on an elapsed time indicator meter.

b) THREE
PHASES IN
ENGINE
START

There are three phases in an engine start. 1) In the first phase, fuel starts to flow, engine rotation begins, and the igniter fires. 2) In the second phase, after the engine has lit off, the system checks the oil pressure. 3) In the last phase, if the oil pressure is normal, voltage to the starter is cut off automatically, the generator regulates output voltage, and voltage for the igniter is removed. If the oil pressure is low, the engine shuts down.

b. REMOTE CONTROL
SYSTEM

The remote control system consists of the receiver assembly and the transmitter assembly.

1) RECEIVER
ASSEMBLY

The receiver assembly consists of a whip antenna and a narrow band frequency modulation (FM) receiver. The 24 volts DC power supplied by the smoke generator powers the receiver.

a) RECEEIVER OPERATING RANGES	The receiver operates from 30 to 87.975 megahertz (MHz) with a 25 kilohertz (kHz) channel separation
b) FIVE KILOMETER LINE OF SIGHT DISTANCE	The receiver is the remote control interface between the smoke generator and portable transmitter assembly that may be located up to 5 kilometers line-of-sight from the generator.
c) TEN DIFFERENT FREQUENCIES	<p>The receiver can be programmed with 10 different frequencies within its frequency range. Each frequency is set by changing the channel switch to the desired number.</p> <p>The smoke generator can be controlled remotely when the selector switch on the cabinet is positioned to REMOTE CONTROL.</p>
2) TRANSMITTER ASSEMBLY	The transmitter assembly consists of a portable FM transmitter and antenna.
a) POWERED BY 12 VDC BATTERY	Power is supplied by a 12 volts DC sealed lead-acid battery. The battery is charged by a 110/220 volts AC to DC converter charger.
b) BATTERY CONDITION	<p>A bi-color status LED provides the condition of the battery and radio frequency (RF) output power.</p> <p>Both the transmitter and receiver can be operated individually, as a group, or as part of an entire smoke generator system.</p>

c. FUEL SUPPLY

One 55-gallon drum of fuel is needed to operate the smoke generator. The fuel drum is connected to the smoke generator by a 1/2 inch hose with a quick-disconnect coupling. The coupling connects to the fuel inlet on the smoke generator cabinet.

d. MULTI-FUEL
CAPABLE

The turbojet engine is capable of multi-fuel-type operations. The fuel used will depending upon the ambient temperature.

e. SMOKE
MATERIAL
SUPPLY

Two 55-gallon drums of smoke material are needed.

1) USE HOSE TO
SUPPLY

The material is supplied to the smoke generator using a hose assembly quick-connected on one end to the smoke generator. The other end is connected to a tee which branches off to each of the smoke material drums.

The generator is capable of generating smoke using many types of smoke material depending upon the ambient temperature.

INSTRUCTORS NOTE: Use Tables 4-2 through 4-4 of T.O. 11c12-2-7-1 along with either the smoke generator system or figures 4-10 through 4-12 to demonstrate cabinet, receiver, and transmitter assembly controls and indicators.

MAIN POINT 4.
CONTROLS,
INDICATORS, AND
OPERATING
INSTRUCTIONS

The controls and indicators are located in three major parts of the smoke generator system: the smoke generator cabinet, the receiver unit, and the transmitter assembly.

The controls and indicators allow the operator to control different aspects of the system and to determine if the system is operating correctly.

INSTRUCTORS NOTE: USE THE OPERATING PROCEDURES IN T.O. 11C12-2-7-1, CHAPTER 4 FOR MANUAL AND REMOTE CONTROL OPERATIONS AS REQUIRED. ALSO, YOU SHOULD TEACH BOTH NORMAL AND EMERGENCY OPERATIONS.

MANUAL AND
REMOTE CONTROL
OPERATING
INSTRUCTIONS

Operating instructions fall under two categories: manual and remote control. Within each of the categories we will cover both normal and emergency operating instructions.

TRANSITION:

Now let's go step by step through the procedures and then each of you will do the same.

CONCLUSION

SUMMARY:

Today we have covered:

1. Purpose and scope of the smoke generator
2. Safety precautions to adhere to
3. Theory of operation for:
 - a. Smoke generator
 - b. Remote control system
 - c. Fuel supply
 - d. Smoke material supply
4. Operating instructions

REMOTIVATION:

You may be called upon to set up and operate this system at any point in a war or contingency. Air base survival may depend upon your ability to use the training you've received today.

TRANSITION:

(Develop locally to transition to the next topic.)

PART III
EVALUATION

STUDENT PERFORMANCE STANDARDS

1. Inspect the smoke generator for serviceability.
2. Assemble and prepare the smoke generator for use.
3. Operate the smoke generator as described in the technical order (T.O.)
4. Shut down the smoke generator.

TEST ITEMS

1. LESSON OBJECTIVE: Identify the main purpose of the smoke generator system.

QUESTION: (True or False)

The main purpose of the smoke generator system is to cover operations from enemy view; therefore, effectively implementing the principle of disguise.

- a. True
- b. False

KEY: b

REFERENCE: Main Point 1

2. LESSON OBJECTIVE: Identify safety requirements of the smoke generator.

QUESTION: (Multiple Choice)

Who should you contact for additional guidance concerning the wear of personal protective equipment approved for the materials, equipment, and tools being used while operating the A/E32U-13 Smoke Generator?

- a. Wing Safety Office or Base Bioenvironmental Engineer.
- b. Wing Safety Office or Base Disaster Preparedness Office.
- c. Director of Base Medical Services or Base Disaster Preparedness Office.
- d. Base Disaster Preparedness Office or Environmental Engineering Management Office.

KEY: a

REFERENCE: Main Point 2

PART IV
RELATED MATERIALS

1. None

TRAINING PACKAGE COMMENT REPORT

RTP # _____

RTP DATE: _____

For an *immediate response* to your questions concerning subject matter in this Readiness Training Package (RTP), contact the Office of Primary Responsibility(OPR)TSgt Ron Childs of the Contingency Training Section at DSN 523-6458 between 0700-1600 (CT), Monday through Friday. Otherwise, write, fax, or E-mail the OPR to make comments, suggestions, or point out technical errors in the areas of: references, body information, performance standards, test questions, and attachments.

NOTE: Do not use the Suggestion Program to submit corrections for printing or typographical errors.

Comments: _____

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